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Prognostic significance of abnormal ultrasonographic findings during the second trimester of gestation

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While dealing with the **problem of congenital cardiac malformations in perinatology,** we noted that the intrauterine cephalometric measurements in infants with transposition of the great vessels, observed during the second trimester of pregnancy, were abnormal [4]. It was assumed that at this time of gestation, pathology was more likely caused by reduced potential of fetal growth rather than by placental insufficiency [1].
This finding lead us to conduct a **retrospective study of the cases with pathological cephalometry in the mid-trimester** and to evaluate the meaning as well as the prognostic significance of abnormal fetal development prior to the 28th week of gestation.

1. Methods and material

The routine examination was carried out using the echoscopic (Vidoson 635, B-scan, SIEMENS, W. Germany) and ultrasonographic (A- and B- transverse scan, KRETZ 4100, Austria) methods [3]. The evaluation of the fetal biparietal diameter was done with reference to our standard curve (fig. 1) of intrauterine fetal biparietal growth (SIUBG [2]). The 1500 analyzed cases (more then 5000 ultrasonic explorations) consisted of 1336 (89%) cases with normal cephalometry and **164 (11%) with pathological measurements.** In 69 cases (4.6%) with abnormal biparietal measurements, it was necessary to readjust the estimated gestational age, while the remaining 95 cases (6.9%) were considered for further analysis. From the 95, 61 cases were below and 34 cases above our SIUBG.

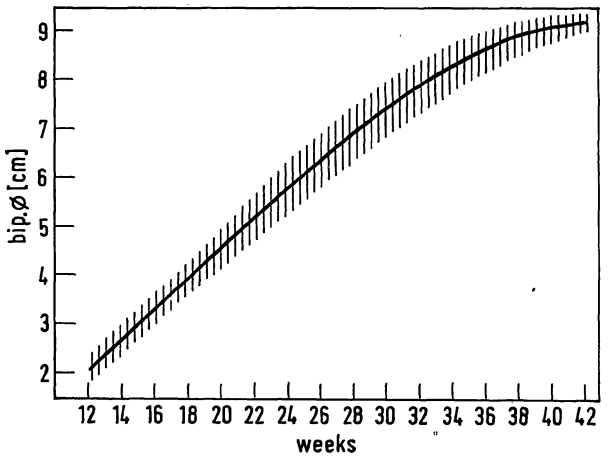

Fig. 1. Our standard curve of biparietal diameter growth during pregnancy (12th—42nd week of gestation).

Curriculum vitae

MICHAEL S. RAMZIN *was born in 1938 in Belgrade, Yugoslavia, the son of a physician. His high school education and medical studies were completed in Belgrade.*
From 1964—1966 he was employed in the clinics of the University of Belgrade; from 1967—1969 he worked in the unit for intensive care of newborn infants Department of Obstetrics and Gynecology, University of Basel, Switzerland, (Chairman: Prof. Dr. Th. Koller).
During the years 1969—1972 he specialised in obstetrics and gynecology in the Department of Obstetrics and Gynecology, University of Basel, (Chairman: Prof. Dr. O. Käser).
His main fields of interest are the surveillance of the intrauterine fetus and the newborn infant immediately after birth.

2. Results

2.1 Cases with measurements below SIUBG (tab. 1)

20 (33%)	Small-for-date infants (under 10 percentiles according to THOMSON)
10 (17%)	Fetuses died before the 28th week of gestation
8 (18%)	imminent abortion (pathological placentation)
7 (11%)	Malformations
	$p < 0{,}01$
16 (26%)	Normal infants after normal pregnancies

Tab. 1. Abnormal cephalometry in the 2nd trimester of pregnancy below SIUBG (n = 61).

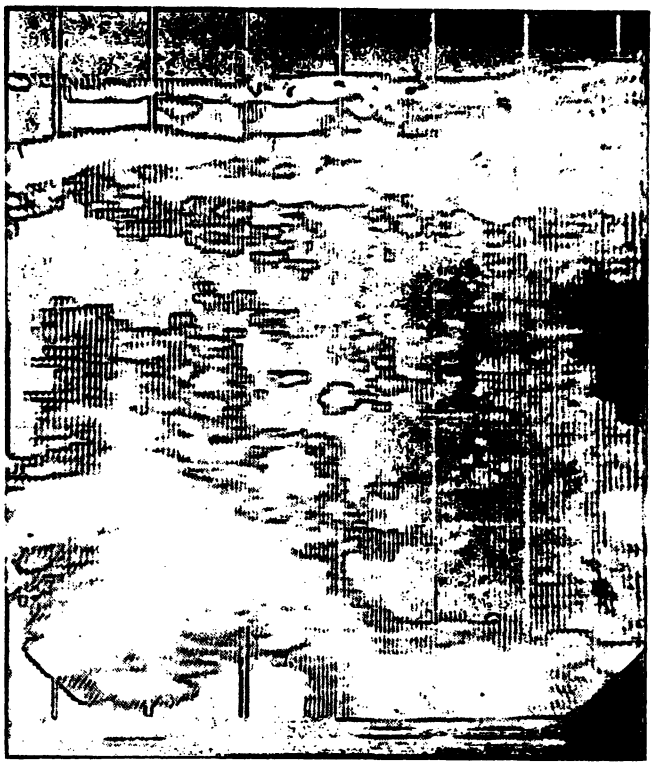

Fig. 2. Placenta praevia with retroplacental haematoma (16th week of pregnancy).

Twenty infants from the selected group of 61 were **severely** retarded (with birth weight under 10 percentiles according to THOMSON [6]). The retardation was found **to have occurred prior to the 24th week of gestation** and was probably due to reduced fetal growth potential.

Ten infants **died before the beginning of the 28th week of gestation.** A study of the case history of these patients revealed **infertility** in 6 cases. In 8 cases, the pregnancy was disturbed by **faulty placentation,** causing retroplacental hemorrhages, as confirmed by ultrasonic exploration. One of those cases is shown in fig. 2. **Seven infants were malformed** and in 16 cases pregnancy proceded normally with healthy newborns.

Statistical analysis showed that the rate of fetal pathology had increased significantly ($p < 0.01$) in cases with early retarded biparietal growth (tab. 1).

2.2 Cases with measurements above SIUGB (tab. 2)

Among the infants with biparietal diameters above our SIUBG in the mid-trimester we found:

13 (38%)	Large-for-date infants (over 90 percentiles according to THOMSON)	
6 (17%)	Malformations	
		$p > 0{,}05$
15 (45%)	Normal infants after normal pregnancies	

Tab. 2. Abnormal cephalometry in the 2nd trimester of pregnancy above SIUBG (n = 34).

In 13 cases, **large-for-date infants** (with birth weight over 90 percentiles according to THOMSON [6]). From this group, in 6 cases we diagnosed a pathologic carbohydrate metabolism in the mother. **Six infants were malformed** and 15 babies were normal after an uneventful pregnancy. Fetal pathology had not statistically increased when biparietal diameter was above our SIUBG.

2.3 Fetal malformations (tab. 3)

In our series of 1500 cases we found 24 infants with congenital malformations [5]. **In 13 of these cases, the biparietal diameter was found to be abnormal.** The distribution of cases with biparietal diameters above and below our standard

Abnormal cephalometry (n = 13)	below SIUBG (n = 7)	Transposition of the great vessels (twice)
		Anencephalus
		Diaphragmatic hernia
		POTTER syndrome
		Multiple skeletal malformations
		Partial aplasia of the thyroid
	above SIUBG (n = 6)	Multiple malformations (twice)
		Hydrocephalus
		Diaphragmatic hernia
		Meningomyelocele
		Ventricular septal defect
Pathologic transverse scan (n = 2)		Cranium bifidum
		Sacrococcygeal teratoma
Normal ultrasonic findings (n = 9)		DOWN's syndrome (7 cases)
		Tetralogy of FALLOT
		Cor triloculare biatriatum

Tab. 3. Fetal malformations (n = 24).

Fig. 3. Sacro-coccygeal teratoma in the 26th week of pregnancy.

Fig. 3a. The same case after delivery.

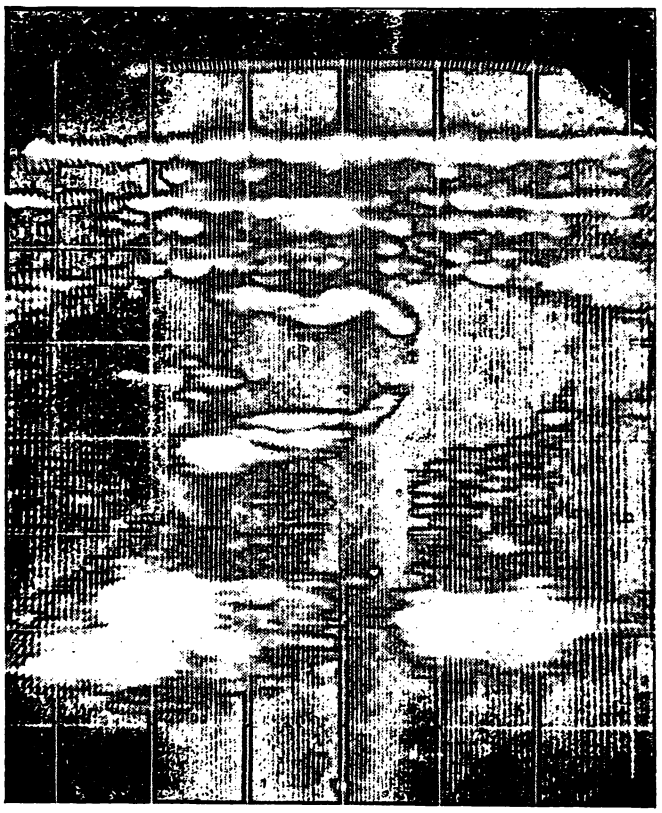

Fig. 4. Caput bifidum (15th week of gestation).

Fig. 4a. The same case after delivery.

curve was about equal. Two children had normal biparietal diameters but a pathological transverse scan (figs. 3 and 4a): Cranium bifidum, sacrococcygeal teratoma.

Down's **syndrome** appeared 7 times among the 9 malformed infants with **normal mid-trimester cephalometry and transverse scan.** The ultrasonic exploration could not predict the outcome of these cases, although usually **fetal malformation could be recognized by or suspected from the often occompanying hydramnios.** In our series Down's Syndrome was diagnosed after delivery.

Among the cases with normal ultrasonic findings we also found one infant with cor trilioculare. biatriatum and one with a tetralogy of Fallot

3. Comment

The **probability that the infant will be malformed if its biparietal diameter is abnormal** during the 2nd trimester of gestation was in our material **13.5%** (13 out of 95 cases). The rate of fetal malformation in cases **with normal biparietal diameters** was only **0.06%.** (9 out of 1405 cases). The difference is statistically highly significant ($p < 0.001$) (tab. 4).

Abnormal cephalometry (n = 95)	*13.6 %	(13/95)
		$p < 0.001$
Normal cephalometry (n = 1405)	0.06%	(9/1405)

Tab. 4. Probability quotient — fetal malformation (2nd trimester); * exact limits of confidence 7,5%—22.3%.

Summary

More than 5000 routine ultrasonic explorations were carried out on 1500 patients during the mid-trimester of pregnancy. The combined methods of echoscopy and ultrasonography were employed. The retrospective study revealed that in **89%** (n = 1336) **of the cases the biparietal diameter of the fetal head was within normal limits** with reference to our standard curve (fig. 1) of intrauterine fetal biparietal growth (Siubg).

In 11% of the cases (n = 164) the biparietal diameter was found to be abnormal. **Of this group, the estimated gestational age had to be readjusted in 69 cases (4.6%)** and the remaining 95 cases (6.4%) were suitable for further analysis.

The biparietal diameter during the mid-trimester was below Siubg in 61 cases and above the standard curve in 34 cases. This group (n = 95) of abnormal cephalometry according to our Siubg during the 2nd trimester revealed (tabs. 1 and 2): In **35%** (n = 33) of the cases a **pathological growth potential** (exact limits of confidence 20—45%), in **13.5%** (n = 13) **malformation** of the infants (exact limits of confidence 7.0—23%), in **10.5%** (n = 10) **intrauterine death** prior to the 28th week of gestation (exact limits of confidence 5%—18%), in **8%** (n = 8) a **pathological placentation** (exact limits of confidence 4%—16%) (fig. 2) and in only 33% (n = 31) normal infants after uneventful pregnancy (exact limits of confidence 23%—46%).

The **probability that the infant will be malformed if its biparietal diameter is below or above** our Siubg was found to be 13 out of 95 cases **(13.6%** — exact limits of confidence: 7.5%—22.3%). In the cases **with normal biparietal diameter** (according to Siubg) the malformation quotient was only **0.06%** (tab. 4).

Among **24 infants born with congenital malformations** (tab. 3) **15 had pathological ultrasonic findings** during the mid-trimester. However, two of the 15 cases with normal biparietal growth showed abnormal transverse scan (figs. 3 and 4a).

A normal cephalometry and normal transverse scan were obtained during the 2nd trimester in the 7 newborn infants with Down's Syndrome (mongolism) and in 2 infants born with congenital heart malformations.

Keywords: Fetus, growth, malformations, placenta, midtrimester, echoscopy, ultrasonography, cephalometry, scan.

Zusammenfassung

Prognostische Bedeutung abnormer Ultraschall-Befunde im 2. Schwangerschaftsdrittel

Die ultraschalldiagnostische Untersuchung im 2. Schwangerschaftsdrittel wird bei uns routinemäßig unter Verwendung einer kombinierten echoskopisch-ultrasonographischen Methode durchgeführt. Bei 1500 Fällen mit mehr als 5000 Untersuchungen wurde eine retrospektive Analyse durchgeführt. Diese Analyse zeigte, daß **in 89% der Fälle (n = 1336) die Meßwerte des biparietalen Durchmessers in den Normbereich** unserer Wachstumskurve (Siubg) fielen (Abb. 1). Bei 4,6% der Fälle konnten abnorme Maße durch ein falsches Gestationsalter erklärt werden. Die restlichen 6,4% der Fälle (n = 95) wurden einer genaueren Betrachtung unterzogen.

Von den 95 Fällen mit abnormer Kephalometrie (61 unter und 34 über Siubg) im 2. Schwangerschaftsdrittel zeigten (Tab. 1, 2): **35%** n = 33) ein **abnormes Wachstumspotential** (genaue Vertrauensgrenzen 25%—45%), **13,5%**

(n = 13) **Mißbildungen** bei der Geburt (genaue Vertrauensgrenzen 7,5%—23%), **10,5%** (n = 10) nachfolgenden **intrauterinen Fruchttod** vor Abschluß der 28. Schwangerschaftswoche (genaue Vertrauensgrenzen 5% bis 18%), **8%** (n = 8) eine **gestörte Plazentation** (genaue Vertrauensgrenzen 4%—16%) (Abb. 2) und lediglich **33%** (n = 31) ein normales Kind bei der Geburt nach unauffälligem Schwangerschaftsverlauf (genaue Vertrauensgrenzen 23%—64%).

Die **Wahrscheinlichkeit, daß ein Fet mit abnormem Kephalometriemaß im 2. Schwangerschaftsdrittel mißgebildet ist, beträgt** 13/95 **(13,6%)** mit den genauen Vertrauensgrenzen von 7,5%—22,3%, während bei **normalem Maß** die Wahrscheinlichkeit bei **0,06%** liegt (Tab. 4).

Abnorme Ultraschallbefunde im 2. Schwangerschaftsdrittel sprechen gegenüber normalen Befunden **hochsignifikant** häufiger für einen pathologischen Zustand des Kindes.

Ausgehend von den insgesamt 24 mißgebildeten Kindern in unserem Kollektiv (Tab. 3) zeigten 15 Fälle einen abnormen Ultraschallbefund im 2. Schwangerschaftsdrittel (2 davon allerdings bei normalem Wachstumsverlauf des biparietalen Durchmessers) (Abb. 3, 3a, 4, 4a). Hingegen wiesen 7 Neugeborene mit Down's Syndrom (Mongolismus) und 2 mit Herzmißbildungen keine abnormen Ultraschallbefunde in diesem Schwangerschaftsabschnitt auf.

Schlüsselwörter: Fetus, Wachstum, Mißbildungen, Plazenta, 2. Schwangerschaftsdrittel, Ultraschall, Kephalometrie, Scan

Résumé

La valeur prognosticale des explorations ultrasonodiagnostiques anormales pendant le deuxième trimestre de la grossesse

L'exploration ultrasonodiagnostique au cours du second trimestre de la grossesse constitue dans notre service un examen de routine pratiqué à l'aide d'une méthode combinée échoscopique et ultrasonographique.

Ce travail présente une analyse rétrospective portant sur 1500 cas totalisant plus de 5000 examens ultrasoniques.

En conclusion de cette étude, il convient de relever les données suivantes: **dans 89% des cas** (n = 1336), **la valeur du diamètre biparíétal est comprise dans les limites de la norme** définie par la courbe standard (fig. 1) de croissance intrautérine du diamètre biparíétal (Siubg); dans 4,6% des cas, les mensurations sortant de la norme sont à mettre sur le compte d'une erreur concernant l'âge gestationnel.

Dans 6,4% des cas, soit chez 95 gestantes, les valeurs du diamètre biparíétal sont soit trop élevées (34 cas) soit endessous des limites de la norme (61 cas). Parmi ces 95 cas caractèrisés par un diamètre biparíétal anormal (tabls. 1, 2): **35%** (n = 33) présentaient un **potentiel de croissance anormal** (limites exactes de fiabilité 25%—45%), **13,5%** (n = 13) étaient atteints d'une **malformation** à la naissance (limite exacte de fiabilité 7,5%—23%), **10,5%** (n = 10) concernaient des **morts intra-utérines** survenues avant la 28ième semaine (limites exactes de fiabilité 5%—18%), **8%** étaient en rapport avec des **troubles de la placentation** (limites exactes de fiabilité 4%—16%) (fig. 2). Enfin dans 35% des cas (n = 31), il s'agissait de grossesses normales terminées par la naissance d'un enfant normal.

La **probabilité qu'un foetus présentant une céphalométrie anormale au cours du second trimestre de la grossesse soit atteint d'une malformation s'élève à 13,6%,** soit dans notre étude 13 cas sur 95 (limites exactes de fiablité 7,5%—22,3%). Par contre, lorsque la céphalométrie fournit des valeurs comprises dans les **limites de la norme,** cette probabilité n'est que de **0,06%** (tab. 4).

Lorsque l'examen pratiqué au cours du second trimestre permet de mettre en évidence une anomalie ultrasonique quelconque, il faut s'attendre à un **état pathologique de l'enfant statistiquement plus souvent** que lorsque cet examen est sans particularité.

Parmi les 24 enfants malformés de notre collectif (tab. 3), 15 présentaient une anomalie ultrasonique lors de l'examen du second trimestre (dans 2 cas, la croissance du diamètre biparíétal était cependant normale (fig. 3, 3a, 4, 4a).

Par contre chez 7 nouveau-nés mongols ainsi que chez 2 enfants atteints d'une malformation cardiaque, aucune anomalie n'avait pu être décelée par cet examen.

Mots-clés: Foetus, malformation, placenta, exploration ultrasonodiagnostique, cephalométrie, second trimestre.

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